Los Alamos
Inertial Confinement Fusion

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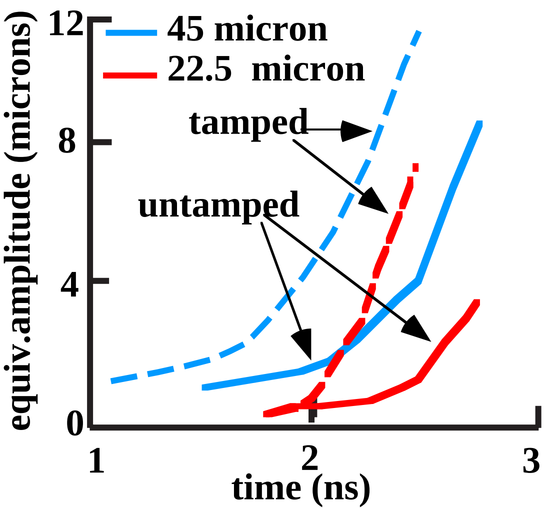
Target Experiments:
Thin Shell Instabilities

We have initiated an experimental series on the material - pressure driven Rayleigh-Taylor (R-T) instability with four shots on NOVA. The basic idea in this experiment is to compare the growth of an initial milled perturbation of a given wavelength and amplitude in a copper foil driven by hohlraum radiation under two different conditions. In the first case the hohlraum radiation is filtered through a Be foil 100 mm in front of the corrugated copper foil. The foil is ablatively driven by the filtered hohlraum radiation without material pressure from the Be. In the second case, the Be is deposited on top of the Cu foil corrugations. In this case, the Be filters the radiation for the ablative drive as before, but also provides a material pressure drive to the Cu. The difference in foil acceleration and R-T growth between the two cases is purely the material pressure of the Be. Rage simulations for this comparison have been done in XTA and are shown here.



This shows the equivalent amplitude of R-T growth for the fundamental and second harmonic for the filtered-tamped and filtered case for a 45 µm wavelength .5 µm initial perturbation. As expected, the filtered-tamped case provides material pressure for a higher foil acceleration and hence larger growth rate. Presumably, the tamper also affects the ablative stabilization. A preliminary check on the data from the four Nova shots confirms a slightly larger growth for the filtered-tamped case.

Target Fabrication:
Partial Filling of a NIF Beryllium Ignition Target with Deuterium

Fabrication and characterization of a NIF-size Be ignition target has recently been reported. Efforts are now underway to develop a process for filling this target design with DT. The NIF Be ignition target design will require 350 atm of DT fill. A number of methods are being considered for filling these targets. One filling method under consideration is permeation of DT through the target wall at high temperature and pressure. An experiment has been conducted to assess the feasibility of permeation filling these targets. On the Weapons Engineering Tritium Facility (WETF) DT filling system, the previously fabricated Be target was exposed to high pressure (285 atm) deuterium at 400°C for four days. Resonance ultrasound spectroscopy (RUS) was used to measure the target fill pressure. The pressure at room temperature was measured to be 73 atm, indicating that at 400°C, 167 atm had permeated into the target. The figure shows the agreement between the RUS pressure measurement and permeation calculations performed using literature data. Further data will be collected at different pressures, temperatures, and times to increase our confidence in the ability to model the permeability of deuterium into the Be target. Such a model will be used to establish the conditions (pressure, temperature, and time) required to fill a NIF Be target to 350 atm with DT.